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[Claims]

[Claim 1]

A method for producing a composite material, comprising the steps of:

arranging a porous carbon member having a desired shape obtained from
5 defatted rice bran as a raw material in a molding die; and

supplying a thermosetting resin in a liquid state mixed with a non-metallic
fiber in the molding die either before and after, or after arranging the porous carbon
member in the molding die so as to integrate the porous carbon member with such
fiber-reinforced thermosetting resin, and also expose a portion of the porous other
10 carbon member by curing the thermosetting resin.

[Detailed Description of the Invention]

[0001]

[Technical Field to which the Invention Belongs]

The present invention relates to a method for producing a composite material.

15 [0002]

[Prior Art]

For example, a machine tool required for precision machining is assembled at
a given temperature taking an expansion by a temperature change into consideration,
transported and, further, a temperature in a factory in which the machine tool is
20 operated is adjust-controlled. A carbon fiber-reinforced composite material which is
almost free from a thermal expansion by the temperature change and has a favorable
vibration absorption property is suitable as a member for the machine tool. However,
since the composite material is large in sliding abrasion, there is a problem in that a
site in the machine tool in which the composite material is used is limited.

25 [0003]

Under these circumstances, a metallic member is embedded in a site in the machining tool in which abrasion resistance is required. However, since the metallic member is large in a coefficient of thermal expansion, there is a problem in that reliability in adhesion with other members constituting the machine tool is inferior.

5 [0004]

[Means for Solving the Problem]

The present invention is to provide a method for producing a composite material in which a porous carbon member which is small in sliding abrasion is integrated with a fiber-reinforced thermosetting resin which has a favorable vibration
10 absorption property.

[0005]

[Means for Solving the Problems]

A method for producing a composite material related to the present invention comprising the steps of:

15 arranging a porous carbon member having a desired shape obtained from defatted rice bran as a raw material in a molding die; and

supplying a thermosetting resin in a liquid state mixed with a non-metallic fiber in the molding die either before and after or after arranging the porous carbon member in the molding die so as to integrate the porous carbon member with such
20 fiber-reinforced thermosetting resin, and also to expose a portion of the porous carbon member by curing the thermosetting resin.

[0006]

[Mode for Carrying Out the Invention]

Hereinafter, the present invention is described in detail.

25 Firstly, defatted rice bran which is adopted as a raw material is added with a

thermosetting resin such as a phenol resin and, then, the resultant mixture is formed and, thereafter, the resultant formed product is, after optionally subjected to machining such as cutting, carbonize-fired at 500 to 1100°C in an atmosphere of an inert gas such as nitrogen, to thereby prepare a member involving porous carbon (Rice Bran
5 Ceramics; RB Ceramics) having a desired shape. Subsequently, such Rice Bran Ceramic member as described above is arranged in a predetermined site in a molding die.

[0007]

Next, a thermosetting resin in a liquid state mixed with a non-metallic fiber is
10 supplied in the molding die either before and after or after arranging of the porous carbon member as described above in the molding die and, then, by curing the thermosetting resin so that the porous carbon member is integrated with such fiber-reinforced thermosetting resin as described above, and also a portion of the porous carbon member is exposed on a site required for abrasion resistance.

15 [0008]

As for the non-metallic fiber, for example, a single fiber or composite fibers selected from a carbon fiber, a glass fiber and an aramid fiber can be used. Particularly, from the viewpoint of approximating a coefficient of thermal expansion thereof to that of the RB Ceramic member, the carbon fiber is preferably used.

20 [0009]

As for the thermosetting resin, for example, an epoxy resin, a phenol resin or an unsaturated polyester resin can be used. As for the thermosetting resin in the liquid state mixed with the non-metallic fiber, for example, a prepreg having a structure in which a semi-cured thermosetting resin is impregnated in a fabric which is
25 made of the above-described fiber can be used.

[0010]

As described above, according to the present invention, the porous carbon member (RB Ceramic member) having the desired shape obtained from the rice bran as a raw material is arranged in the molding die and, then, the thermosetting resin in the liquid state mixed with the non-metallic fiber is supplied in the molding die either before and after or after such arrangement of the RB Ceramic member and, thereafter, by curing the thermosetting resin, so that the porous carbon member is integrated with the fiber-reinforced thermosetting resin and also a portion of the porous carbon member is allowed to be exposed. Accordingly, the composite material involving the fiber-reinforced thermosetting resin, which is almost free from the thermal expansion by the temperature change and has the favorable vibration absorption property and the RB Ceramic member which is integrated with the fiber-reinforced thermosetting resin and is low in abrasion resistance, can be produced.

[0011]

Namely, the RB Ceramic member can be produced, as described above, such that the defatted rice bran is adopted as the raw material and, then, the defatted rice bran is mixed with the thermosetting resin such as the phenol resin and, after the resultant mixture is molded, the resultant molded product is optionally subjected to machining such as cutting and, thereafter, the molded product is carbonize-fired at 500 to 1100°C in the atmosphere of the inert gas such as nitrogen. This RB Ceramic member has high hardness comparable to that of hardened steel, high strength and light weight and also has a low friction property and an excellent abrasion resistance. Further, since the formed product before firing is soft, it can easily be machined into an arbitrary shape.

[0012]

Still further, the fiber-reinforced thermosetting resin which is a formed product of the thermosetting resin in a liquid state mixed with the non-metallic fiber has such characteristics as is almost free from the thermal expansion by the temperature change and has the favorable vibration absorption property.

5 [0013]

According to the present invention, the RB Ceramic member having the above-described properties and the desired shape is arranged in the molding die and, then, the thermosetting resin in the liquid state mixed with the non-metallic fiber is supplied in the molding die and, thereafter, by curing the thermosetting resin, the
10 composite material which involves the fiber-reinforced thermosetting resin which is almost free from the above-described thermal expansion and has the favorable vibration absorption property and the RB Ceramic member which is partially exposed in a site required for the abrasion resistance and is integrated with the above-described resin while having the thermal expansion approximate to that of the RB Ceramic
15 member, and is provided with characteristics of both of the fiber-reinforced thermosetting resin and the RB Ceramic member can be produced.

[0014]

[Advantage of the Invention]

As has been described above, according to the present invention, a method for
20 producing a composite material, in which an RB Ceramic member which is small in a sliding abrasion is integrated with a fiber-reinforced thermosetting resin which is almost free from thermal expansion by a temperature change and has a favorable vibration absorption property, which is useful in various types of structural members such as in a machine tool, and functional members can be provided.